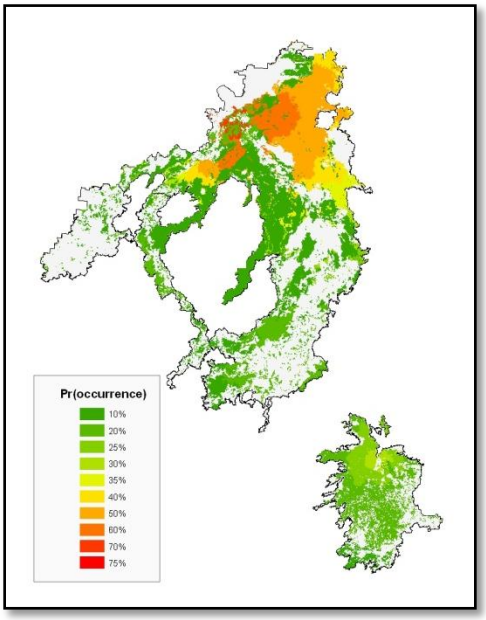
Objective 1:

Habitat use and occupancy modeling



Example map of predicted pika distribution at Craters of the Moon NM&P (from Rodhouse et al. 2010)

Parks included in Objective 1

- Crater Lake National Park
- Craters of the Moon National Monument and Preserve
- Grand Teton National Park
- Great Sand Dunes National Park and Preserve
- Lassen Volcanic National Park
- Lava Beds National Monument
- Rocky Mountain National Park
- Yellowstone National Park

Objective 1

- Determine the distribution, **habitat-specific occupancy rates**, and habitat use of pika within eight NPS units spanning the majority of habitat types, latitudes, longitudes and elevations occupied by this species, using an **occupancy modeling** framework and survey design.
- Use these data to develop databases and **predictive distribution models** (*see map on left for an example*) for pika management within parks and regions.

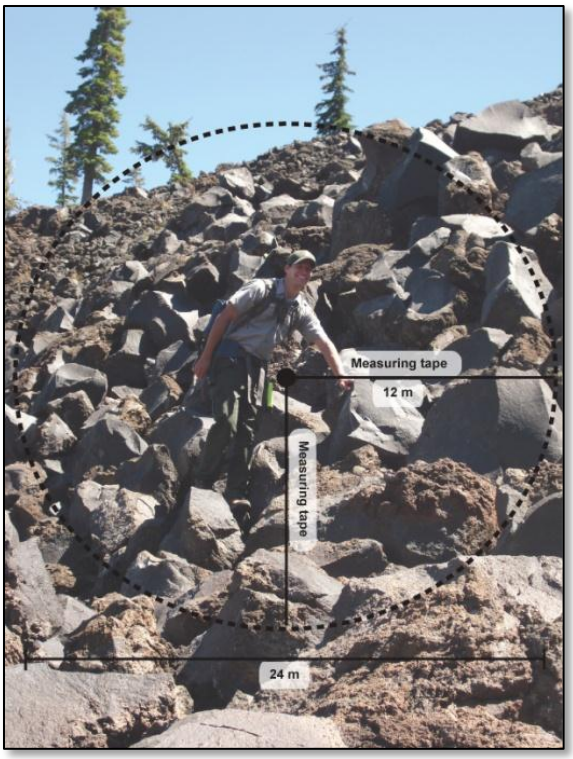
Background

Understanding the relationship between a species and its environment, including specific requirements that define its habitat, is a key step in species conservation. Using information about where species do and do not occur allows researchers to examine the potential importance of different habitat variables. The "Pikas in Peril" research team is using "presence-absence" surveys in 8 national park units to examine how the occupancy of different habitats by pikas varies across **environmental gradients**. Some of the variables being examined may serve as proxies for stresses related to climate change and include elevation, slope, aspect, substrate type, vegetation cover and others. The methods used have been tested in other studies and our protocol includes instructions to ensure consistent data collection across parks and field crews. Once surveys have been completed, the **occupancy** results will be used to develop maps that show the locations where pikas are likely to occur in each park.

Examples of evidence used to indicate the occupancy or use of a site by pikas: fresh scat (left), pika visual and/or aural (call; center), and fresh hay (right)

Study design and methods

Trained field crews conducted pika surveys at over 600 sites across the 8 parks during June-October of 2010. A similar survey effort is planned for 2011. A subset of sites (20%) is being resurveyed to estimate pika detectability, and another subset (30-50%) will be surveyed in both years to control for annual variation in occupancy rates. Surveys are occurring at randomly selected sites using a "**GRTS**" design. The area sampled ("**sampling frame**") varies by park, according to differences in the amount and elevational range of potential pika habitat(s), site accessibility, and safety issues. Occupancy is sampled within plots 12 m in radius (*see right*), about the size of an average pika territory. Occupied plots are those in which the survey crew detected pikas, pika calls, fresh food caches/haypiles, or fresh fecal pellets (i.e., scat). Habitat measurements, such as vegetation cover, are also being collected during surveys.



Above: A technician at a survey site with a diagram of how the 12-m radius plot (= site) might look.

Analyses of occupancy data

Results will include the "**occupancy**" or percent of plots occupied/used by pikas as well as an inference of these results across all suitable pika habitat(s) within a park, via models based on the survey design. Once field surveys are completed, we will model the distribution of pikas as a function of site-specific habitat variables using **logistic regression** and an **information-theoretic approach**. These models, combined with **GIS** data, will then be used to produce maps showing where pikas are predicted to occur across the park. Occupancy data will also be analyzed at regional scales (across multiple parks) using **hierarchical models** that allow the (simultaneous) estimation of park-specific and regional relationships between occupancy rates and habitat types. These results are expected to help resource managers identify areas to target for protection and/or management actions.

Key references

Jeffress, M. R., J. Apel, L. K. Garrett, G. Holm, D. Larson, N. Nordensten, and T. J. Rodhouse. 2011. Monitoring the American pika (*Ochotona princeps*) in the Pacific West Region – Crater Lake National Park, Craters of the Moon National Monument and Preserve, Lassen Volcanic National Park, and Lava Beds National Monument: Narrative Version 1.0. Natural Resource Report NPS/UCBN/NRR—2011/336. National Park Service, Fort Collins, CO.

MacKenzie, D. I., J. D. Nichols, J. A. Royle, K. H. Pollock, L. L. Bailey, and J. E. Hines. 2006. Occupancy estimation and modeling: inferring patterns and dynamics of species occurrence. Elsevier, London, England.

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Stevens, D. L., and A. R. Olsen. 2004. Spatially balanced sampling of natural resources. Journal of the American Statistical Association 99: 262–278.

These handouts were created to provide a brief description of the 3 objectives of the National Park Service Climate Change Response Program funded "Pikas in Peril" research project. For more details regarding the project and why we are studying pikas, please refer to the overall project resource brief and/or the website listed at the bottom of the page. ***Terms in bold*** *are also defined in a* ***glossary*** *(see link).*

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